OREGON mint UPDATE

Spring 2013

Weed Control in Peppermint in Western and Central Oregon

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Field studies were initiated in western Oregon in 2012 to evaluate weed management strategies in peppermint production. These studies were conducted in Benton, Marion, Polk and Jefferson counties. All Western Oregon trials were conducted on commercial fields**.** Weed control programs for mint in Central Oregon often include herbicides that have residual effects restricting planting options after mint harvest. The objective of the Central Oregon study was to evaluate weed control based on spring-applied herbicides to minimize crop rotation restrictions. Many treatments discussed in this report are not labeled for use in peppermint. For a current list of registered treatments refer to the Pacific Northwest Weed Management Handbook (http://pnwhandbooks.org/weed/).

Western Oregon

Evaluation of Registered Herbicide Treatments for Crop Injury and Weed Control Efficacy on Established Stands of Peppermint

The price of terbacil (Sinbar WDG) dramatically increased over the past year and many field consultants and agronomists indicated they were interested in a demonstration of currently labeled weed management programs in mint that did not include terbacil. Therefore, terbacil, sulfentrazone (Spartan 4F), clomazone (Command 3ME), pendimethalin (Prowl H_2O), flumioxazin (Chateau WDG), oxyfluorfen (Goal2XL) and diuron (Diuron 4L), were applied to dormant, established peppermint in combination with paraquat (Gramoxone Inteon) at two sites. One study (Table 1) was located near Stayton, Oregon in Marion County and the other site was located on Kiger Island in Benton County. Applications at both sites were made in early February. Visual evaluations of the mint stand health as well as weed control efficacy were completed.

Slight injury, ranging from 2 to 12 percent, was observed in late April at the Stayton site in all treatments compared to the untreated control. Injury was 5 percent from the sulfentrazone and oxyfluorfen treatments, 6 percent from the clomazone treatment and 12 percent from the flumioxazin treatment. By early June no injury symptoms were noted from any of the treatments. At the Kiger Island site sulfentrazone, pendimethalin and oxyfluorfen treatments resulted in slight injury of 3 percent. Flumioxazin injury was slightly more apparent at 5 percent and injury from clomazone was recorded at 10 percent. However, by early June no injury was apparent at this site as well. Weed pressure was limited at the Stayton site and non-existent at the Kiger Island site. Willow weed was present in Stayton, but was controlled by all treatments. The plots at these sites were not harvested because there were no apparent differences in mint growth and development after the plants recovered from the initial injury symptoms. These results indicate there are several already registered herbicides that can provide alternatives to terbacil use in peppermint.

Table 1. Registered Herbicide Demonstration Near Stayton, OR, 2012

Treatment [1]	Rate	Peppermint Injury[2]	Peppermint Injury[3]	Willow Weed Control[3]
	lb ai/A	----------%----------		
Check		0	0	0
terbacil + Paraquat	0.8 0.25	1	0	100
sulfentrazone + Paraquat	0.313 0.25	5	0	90
clomazone + Paraquat	0.5 0.25	6	0	100
pendimethalin + Paraquat	2.0 0.25	3	0	90
flumioxazin + Paraquat	0.096 0.25	11	0	100
oxyfluorfen + Paraquat	0.25 0.25	5	0	100
diuron + Paraquat	1.0 0.25	3	0	100
LSD (P=.05)		4	0	15
CV		59	0	12

[1]Applied 2/9/2012
[2]Evaluated 4/25/2012
[3]Evaluated 6/25/2012

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(continued from page 1)

Evaluation of Pyroxasulfone (Zidua) and Carfentrazone (Aim) for Crop Safety

Pyroxasulfone is a pre-emergence herbicide that our past research has shown to be safe on peppermint and effectively controls many winter and summer annual weeds, including pigweed species. Two studies were initiated to quantify mint injury potential when applications are made during the peppermint growing season. The purpose of these studies was to determine how late in the spring an application of pyroxasulfone can be made for the purpose of controlling pigweed, without injuring the peppermint crop. Studies were initiated at two locations, one in Independence, Oregon in Polk County on established peppermint (Table 2) and one on Kiger Island in Benton County on a new planting of peppermint (Table 3). Applications at the Independence site were initiated in early February. Treatments included a dormant application of pyroxasulfone applied alone, pyroxasulfone plus carfentrazone and pyroxasulfone plus clomazone followed by carfentrazone. April, May and June treatments of pyroxasulfone and pyroxasulfone plus carfentrazone were also made at the Independence location. Applications at the Kiger Island site were made in February, May and June. These treatments on the newly planted mint at Kiger Island included a dormant application of pyroxasulfone applied alone and a combination treatment of pyroxasulfone plus carfentrazone. A dormant application of pyroxasulfone plus flumioxazin (Fierce) applied at two rates was also included. A second and third timing of pyroxasulfone and pyroxasulfone plus carfentrazone were also made at Kiger Island. Treatments with carfentrazone initially caused substantial injury following treatment, but treatments made early did not affect yield. The pyroxasulfone plus flumioxazin treatment at the higher rate caused substantial injury in the newly planted

Table 2. Pyroxasulfone Timings in Established Peppermint near Independence, 2012

			Annual Bluegrass Control	Bindweed Control	Peppermint Injury	Peppermint Yield fresh	Peppermint Oil Yield
	Rate						
Treatment	lb ai/A	Appl	----------%----------			lb/sample	lb/A
Check			0	0	0	14	47
pyroxasulfone	0.09	A	73	50	0	15	43
pyroxasulfone +	0.09	A	60	67	0	16	50
carfentrazone +	0.0156	A					
clomazone	0.5	A					
pyroxasulfone +	0.09	A	95	83	0	16	46
carfentrazone	0.0156	A					
pyroxasulfone	0.09	B	85	67	0	15	45
pyroxasulfone +	0.09	B	48	0	4	13	41
carfentrazone	0.0156	B					
pyroxasulfone	0.09	C	73	63	0	14	38
pyroxasulfone +	0.09	C	35	73	55	9	31
carfentrazone	0.0156	C					
pyroxasulfone	0.09	D	35	50	0	16	47
pyroxasulfone +	0.09	D	25	30	40	10	17
carfentrazone	0.0156	D					
LSD (P=.05)			48	80	8	4	19
CV			62	97	58	19	32

Table 3. Pyroxasulfone Timings in Newly Planted Peppermint at Kiger Island, 2012

			Peppermint Injury[1]	Peppermint Fresh Yield[2]	Peppermint Oil Yield[2]
	Rate				
Treatment	lb ai/A	Appl	%	lb/sample	lb/A
Check			0	10	57
pyroxasulfone	0.09	A	5	7	43
pyroxasulfone	0.09	B	0	12	65
pyroxasulfone +	0.09	B	0	10	51
carfentrazone	0.0156				
pyroxasulfone	0.09	C	0	9	44
pyroxasulfone +	0.09	C	0	10	52
carfentrazone	0.0156				
pyroxasulfone-flumioxazin	0.143	A	63	6	35
pyroxasulfone-flumioxazin	0.178	A	70	4	10
terbacil	1.2	A	15	8	27
LSD (P=.05)			11	5	32
CV			45	37	52

[1]Evaluated 4/24/2012

[2]Harvested 8/16/2012

mint. Pyroxasulfone did not cause any visual injury (Table 2). Mint was harvested July 5 at Independence and on August 16 at Kiger Island. Data from these studies and similar data from Washington State are being utilized by the IR-4 program to support the potential registration of pyroxasulfone in peppermint.

Central Oregon

Weed Control Programs in Mint Based on Spring Applied Herbicides to Minimize Rotational Restrictions

A field study was conducted in Jefferson County during 2012 in an irrigated mint field. Herbicide efficacy and crop injury were evaluated 15 days after each application. Plots were mechanically harvested and the fresh weight of a 60 square foot section of each plot was quantified.

Herbicide applications were delayed as relatively low temperatures during spring delayed crop and weed growth. Post-application evaluations were limited to crop injury because the weed pressure on the field was low. Treatments that included bromoxynil alone or combined with clopyralid resulted in the highest crop injury, ranging from 9 to 16 percent after the first application and from 11 to 20 percent after the second (Table 4). Lowering the rate of bromoxynil at the second application, when applied alone or with clopyralid, helped reduce the mint injury observed 15 days after the last application. Mint plants recovered from the initial herbicide injury later in the season. The injury caused by two applications of bromoxynil alone and when tank mix with clopyralid was significant enough to affect the fresh weight yield of the plants. The study will be repeated in the 2013 growing season in order to confirm trends observed this year and to include weed control efficacy of the treatments.

These research trials have been viewed by various field consultant groups who manage peppermint in the Willamette Valley and Central Oregon including those from CPS, Wilco Farmers and Wilbur-Ellis among others and by the grower cooperators. Final research results will be presented to peppermint growers at various winter meetings including the Oregon Mint Growers Annual Meeting and Central Oregon Farm Fair.

Table 4. Percent Crop Injury and Harvested Fresh Weight (lb/a) for Individual Treatments in Jefferson County, 2012.

			Peppermint		
	Rate		Injury[1]	Injury[2]	Fresh Yield
Treatment[3]	lb ai/A	Appl	----------%	----------	lb/A
Check			0	0	34,794
bentazon +	2	A	1	1	28,732
quizalofop +	0.0825	A			
bentazon	2	B			
bentazon +	2	A	0	1	30,292
quizalofop +	0.0825	A			
bentazon	1	B			
bromoxynil +	0.38	A	16	16	29,821
quizalofop +	0.0825	A			
bromoxynil	0.38	B			
bromoxynil +	0.38	A	15	11	24,666
quizalofop +	0.0825	A			
bromoxynil	0.25	B			
bentazon +	2	A	2	3	25,569
bromoxynil +	0.38	A			
quizalofop +	0.0825	A			
bentazon +	2	B			
bromoxynil	0.38	B			
bentazon +	2	A	1	4	28,114
bromoxynil +	0.38	A			
quizalofop +	0.0825	A			
bentazon +	1	B			
bromoxynil	0.19	B			
clopyralid +	0.124	A	9	20	23,159
bromoxynil +	0.38	A			
quizalofop +	0.0825	A			
bromoxynil	0.38	B			
clopyralid +	0.124	A	11	13	27,261
bromoxynil +	0.38	A			
quizalofop +	0.0825	A			
bromoxynil	0.25	B			
LSD (P=.05)			4	4	6,170

[1]Evaluated 7/17/12

[2]Evaluated 7/28/12

[3] All treatments included crop oil concentrate at 1% v/v

Evaluation of Coragen® and Avaunt® Insecticides for Control of Mint Root Borer in Central Oregon

Marvin Butler, Rhonda Simmons, Central Oregon Agricultural Research Center and Ralph Berry, Emeritus, Oregon State University

The mint root borer is a common pest in mint production areas throughout the Pacific Northwest. Pheromone traps used to determine fields with high moth populations have been an effective indicator of larval populations during late summer and early fall and to identify fields that should be targeted for insecticide application. The product of choice to control mint root borer has traditionally been Lorsban applied in the fall, which requires application of water to move the product into the soil for control of larvae.

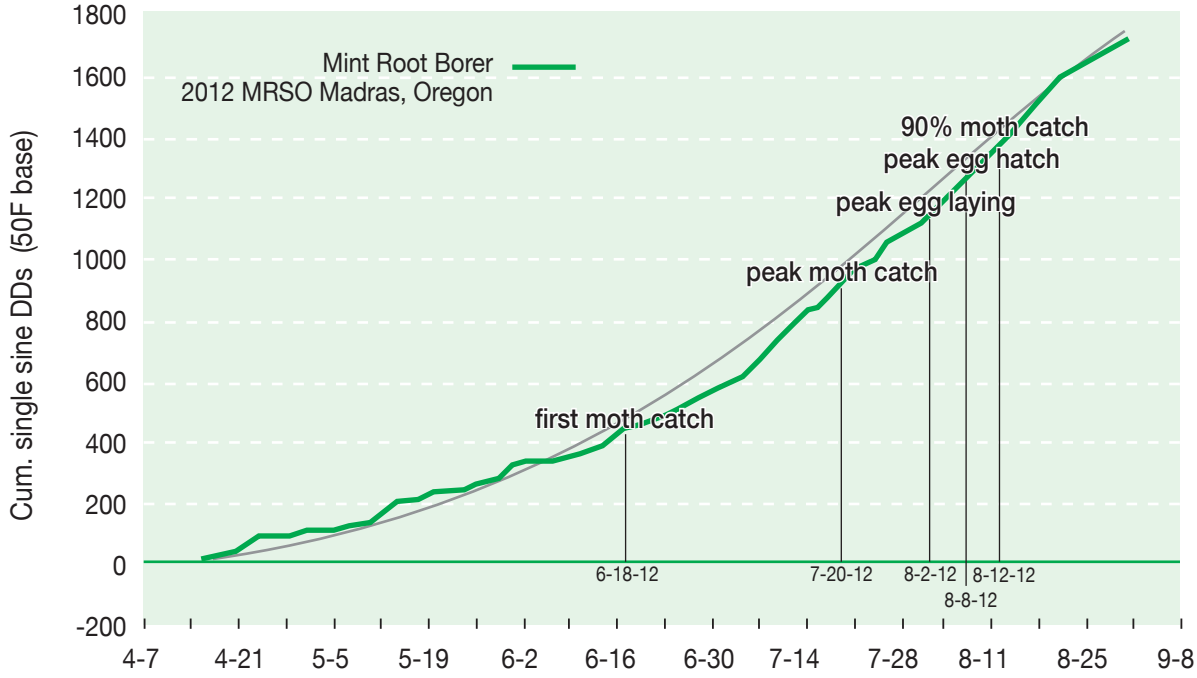
During the 2011 season, the *Integrated Pest Management on Peppermint 3.0* (IPMP) degree day model designed by Berry and Coop (http://uspest.org/mint/) to predict mint root borer development was compared with field data to confirm the model's ability to predict peak moth flight, peak egg laying and peak egg hatch (Figure 1). Based on field observations there was good correlation with developmental model predictions.

The objective of this project was to determine the optimal application timing of two insecticides, Coragen® and Avaunt®. Coragen is registered for control of cutworms, loopers and mint root borer in peppermint and Avaunt is registered for control of spotted cutworm and cabbage looper. These products have ovicidal properties to control mint root borer eggs and first instar larvae in Central Oregon. Coragen and Avaunt insecticides were selected as treatments because they are highly effective in controlling target pest species at low use rates with minimal impact on beneficial species. Low toxicity, two week persistence and ovicidal properties to control eggs and first instar larvae early in the season make both products good candidates for integrated pest management programs.

Material and Methods

Pheromone trapping for mint root borer moths focused on nine fields in the Culver area as no mint for oil was grown in the Madras area and no fields in Prineville appeared to have high mint root borer populations. Pheromone traps were monitored weekly from June 18 to July 16, 2012. Two fields with high moth populations were selected for treatment with Coragen and Avaunt followed by root and soil sampling. These were Field 9, located near highway 97 and Field 2, located near the town of Culver. Despite the highest moth population, Field 3 was not selected due to planned removal of the field after harvest. Pheromone traps were removed following peak flight, after fields were identified for insecticide treatments. Field 2 is irrigated by wheel line and Field 9 by lateral move.

Figure 1. Prediction model for Madras, OR, 2012. The green line represents Madras during the 2012 season, the grey line the historic average, predicted peak egg laying was August 2, peak egg hatch was August 8 and 90 percent moth catch was August 12.



Coragen was applied at 5 oz/acre and Avaunt at 3.5 oz/acre at peak flight on July 19, at peak egg laying on July 31 and at peak egg hatch on August 6, 2012 (Table 2). Plots 20 ft x 20 ft were arranged in a randomized block design and replicated four times. Products were applied using a CO_2 backpack sprayer with a handheld boom outfitted with 8002 TeeJet nozzles operated at 40 psi and 20 gallons of water per acre.

Field 9 was swathed on August 14 and Field 2 was swathed on August 17. Soil samples to determine larval numbers were collected at Field 9 on September 10, September 13 and September 19. Sampling dates for Field 2 were September 13 and September 21. A one-foot-squared sample area with a 3-inch depth was collected from each plot, placed in a plastic bag and placed in cold storage. Soil was sifted to check that larvae were not present in the soil after rhizomes were removed for sampling. Larvae were extracted using Berlese funnels for four days using 25 watt bulbs. Due to a limited number of Berlese funnels (eight), samples were initially processed from both fields to determine the relative number of larvae to allow initial focus on the field with the higher overall population. Based on this information, all samples from Field 9 were processed first followed by Field 2. Processing of samples was completed in November.

Table 1. Number of mint root borer moths collected from pheromone traps placed in 9 fields in the Culver area on June 18, 2012.

Field	Location	Number of MRB Moths Collected			
		3-Jul	10-Jul	16-Jul	Total
1	North Culver	8	19	23	50
2	Culver	-	5	76	81
3	Culver	12	36	40	88
4	West Culver	0	4	7	11
5	West Culver	2	6	12	20
6	Culver	3	4	7	14
7	South Culver	2	11	13	26
8	Culver	6	21	21	48
9	East Culver	5	31	33	69

Table 2. Rates of Coragen and Avaunt and corresponding accumulated degree-days of MRB to time insecticide applications.

Treatments	Application Rate (fl oz/acre)	Application Time (degree days)	Developmental Stage	Date Applied
1. Untreated	---	---		
2. Coragen	5 oz	900	Peak moth hatch	July 19, 2012
3. Coragen	5 oz	1,100	Peak egg laying	July 31, 2012
4. Coragen	5 oz	1,250	Peak egg hatch	August 6, 2012
5. Coragen	5 oz	900	Peak moth hatch	July 19, 2012
+ Coragen	+ 5 oz	1,250	Peak egg hatch	August 6, 2012
6. Avaunt	3.5 oz	900	Peak moth hatch	July 19, 2012
7. Avaunt	3.5 oz	1,100	Peak egg laying	July 31, 2012
8. Avaunt	3.5 oz	1,250	Peak egg hatch	August 6, 2012
9. Avaunt	3.5 oz	900	Peak moth hatch	July 19, 2012
+ Avaunt	+ 3.5 oz	1,250	Peak egg hatch	August 6, 2012

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Results and Discussion

The total number of mint root borer moths collected across sampling dates in fields ranged from 11 to 88 (Table 1). Peak flight occurred July 10 through July 16. Results across the three sampling dates from Field 9 indicate Coragen application at peak moth flight (July 19) and a double application at peak moth flight (July 19) and peak egg hatch (August 6) significantly reduced mint root borer larvae compared to the untreated check (Table 3). Similar results were found in Field 2 but the field had overall lower larvae numbers (Table 4) and a larger coefficient of variation. Samples in Field 2 were in cold storage prior to processing through Berlese funnels for a longer period than Field 9, which may have contributed to fewer larvae recovered. Larval numbers following Avaunt applications were similar to the untreated check. Coragen sprayed at peak moth hatch plus peak egg hatch appears to provide control of both eggs and first instar larvae.

Table 3. Number of mint root borer larvae recovered from soil and rhizome samples at Field 9.

Teatments	Development Stage (degree days)	Mint Root Borer Larvae/Sq Ft			
		Sept 10	Sept 13	Sept 19	Average
1. Untreated	---	4.0 bc	7.0 ab	2.5	4.5 a
2. Coragen	Peak moth hatch (900)	2.3 bc	1.8 ab	1.0	1.7 bc
3. Coragen	Peak egg laying (1,100)	3.8 bc	5.0 ab	1.5	3.4 abc
4. Coragen	Peak egg hatch (1,250)	4.3 abc	5.5 ab	3.0	4.3 ab
5. Coragen	Peak moth hatch (900)				
+ Coragen	Peak egg hatch (1,250)	1.0 c	0.3 b	0.8	0.7 c
6. Avaunt	Peak moth hatch (900)	7.5 a	7.3 a	3.0	5.9 a
7. Avaunt	Peak egg laying (1,100)	4.5 ab	6.0 ab	2.3	4.3 ab
8. Avaunt	Peak egg hatch (1,250)	5.3 ab	6.8 ab	3.0	5.0 a
9. Avaunt	Peak moth hatch (900)				
+ Avaunt	Peak egg hatch (1,250)	5.0 ab	7.3 a	1.8	4.7 a
LSD		*3.3*	*6.9*	*NS*	*2.8*

Table 4. Number of mint root borer larvae recovered from soil and rhizome samples at Field 2.

Treatments	Development Stage (degree days)	Mint Root Borer Larvae/Sq Ft		
		Sept 13	Sept 21	Average
1. Untreated	---	1.5 ab	0.8 a	1.1 a
2. Coragen	Peak moth hatch (900)	0.0 c	0.0 b	0.0 c
3. Coragen	Peak egg laying (1100)	0.0 c	0.3 ab	0.1 c
4. Coragen	Peak egg hatch (1250)	0.3 bc	0.0 b	0.1 c
5. Coragen	Peak moth hatch (900)			
+ Coragen	Peak egg hatch (1250)	0.8 abc	0.3 ab	0.5 abc
6. Avaunt	Peak moth hatch (900)	0.0 c	0.3 ab	0.1 c
7. Avaunt	Peak egg laying (1100)	1.0 ab	0.3 ab	0.6 abc
8. Avaunt	Peak egg hatch (1250)	1.8 a	0.3 ab	1.0 ab
9. Avaunt	Peak moth hatch (900)			
+ Avaunt	Peak egg hatch (1250)	0.5 abc	0.3 ab	0.4 bc
LSD		*1.3*	*0.7*	*0.7*

Eleven Things to Consider With the New I-9 Form

Courtesy of Roberta Gruber, Oregon Farm Bureau FEELDS program

The government released a new I-9 Form on March 8, 2013. Be sure to immediately begin using this new form for all new hires. A brief transition time is given but it ends on May 7. Only the newest version may be used after that date. You can find a copy online at www.uscis.gov/files/form/i-9.pdf.

1. Employees who are currently on your payroll should NOT complete this new form. The form they completed when you first hired them is the one to keep. Don't make this mistake.

2. A Spanish form is created but you're not allowed to use it except for your businesses in Puerto Rico. However, you may give the instruction pages in Spanish to employees to read as they complete the English I-9 form. Please don't complete the Spanish I-9 form instead of the English. If you're audited, that mistake will be painful.

3. The new I-9 packet contains nine pages. I know! There are six pages of instructions, two pages of I-9 Form, and one page of List of Acceptable Documents. Yes, new hires must receive all nine pages when completing a blank form. No, you don't have to keep all nine pages after the form is completed, just keep the completed two-page I-9 Form in your records. Did you see that paragraph about the Paperwork Reduction Act? Uh huh.

4. Your employee is responsible for completing all of Section One (first page). The phone number and e-mail address spaces are optional. The Social Security Number is also optional unless you participate in the E-Verify program.

5. Make sure the employee signs Section One when it's completed. You are responsible to make sure that the form is filled out correctly, but you're NOT responsible for verifying the accuracy or truthfulness of the information the employee wrote. Just make sure the required spaces are completed and that the employee marked one of the four boxes in the middle of the page declaring immigration status. If you leave anything blank that is not supposed to be blank, this will really hurt if you're audited.

6. If you (or anyone else) fill(s) out Section One for the new employee then please make sure you (they) complete the "Preparer/Translator" portion of the form. It's okay to help complete the form as long as you indicate that you helped.

7. You (the employer) are responsible for completing all of Section Two (second page). One part that is different on this new form is the requirement for you to write the employee's last name, first name and initial at the top of the form in the space provided. Don't miss this.

8. Section Two is pretty much the same as the previous versions. Take whatever documents the employee provides you (don't ask for specific documents!) as long as they are shown on the List of Acceptable Documents page. Remember: Mexican Consulate cards, Certificates of Naturalization, or a receipt for an initial Resident Alien card are not acceptable documents.

9. If you are given a List A document, that's all you need. Don't add more documents in the other columns "just to make sure." This is bad, bad. If you're given a List B document then you also need a List C document to complete the form properly. List B and List C cannot stand alone but must be completed together. List B and C cannot be completed if List A is done. So "List A" alone, or "List B&C" together. No other combination, okay?

10. Enter the employee's first date of employment in the space and then you sign and date. Don't worry about the 3D barcode space. That's for the auditor.

11. Keep all completed forms throughout the employee's employment. It may be decades. When employment ends, then you may destroy it 3 years after the hire date or 1 year after the termination date, whichever date is latest.

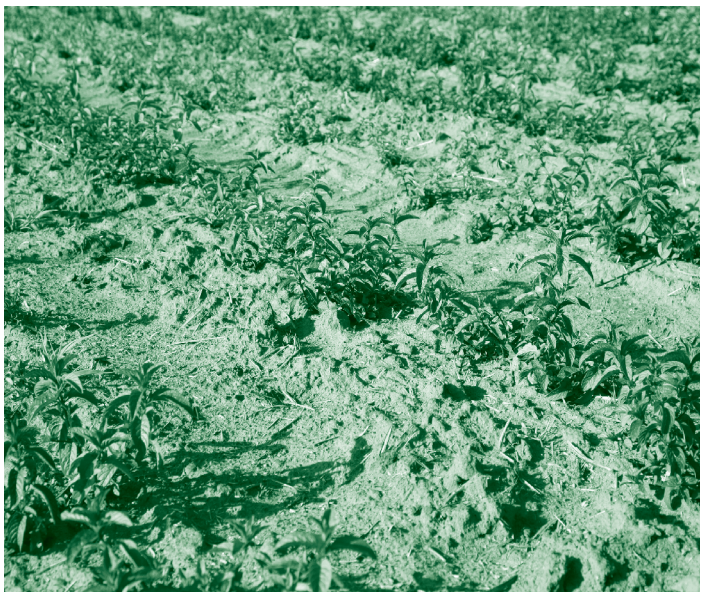
Special thanks to Roberta Gruber at Oregon Farm Bureau's FEELDS program.

Roberta is willing to help growers with additional questions. Contact Roberta at (503) 510-6458 or roberta@oregonfb.org.

The Mint Biotechnology Project Research Activities with the Erospicata Cultivar and Field Trials with Peppermint

Mark Lange, Washington State University

Generation of *Verticillium*-resistant mint lines. We are currently working with a *Verticillium*-resistant mint cultivar termed Erospicata, which was developed by Aromatics Inc. in the 1990s. Erospicata essential oil contains high amounts of menthone, which is an important component of peppermint oil, but it lacks menthol, another key constituent of peppermint. To generate plants that retain *Verticillium* resistance but accumulate an oil with a composition even closer to that of peppermint, we generated a series of transgenic Erospicata lines that were designed for a high activity to convert menthone to menthol. We identified four promoters (strong "on/off switches" for gene expression) that guide the expression of genes to the specialized anatomical structures (glandular trichomes) that carry out essential oil biosynthesis. Three of these promoters (and a construct in which we used a promoter for the expression of MMR everywhere in the plant, not just in glandular trichomes, as a control) have been fused to the gene encoding menthone:menthol reductase (MMR), which is responsible for the menthone-to-menthol conversion in peppermint. Several thousand transgenic events were generated and we have now recovered transgenic plants with significantly increased levels of menthol (up to 5 percent of the essential oil). We have gathered preliminary evidence indicating that the use of these promoters, which are fused to genes that are very highly expressed in peppermint glandular trichomes, might have adverse effects because MMR is expressed too early during glandular trichome development. We are thus exploring another approach that involves transferring a larger construct containing MMR and its natural promoter from peppermint to Erospicata, which should lead to an expression of MMR late during glandular trichome development. The challenge is the cloning of a very large genomic fragment (promoter and MMR gene) from peppermint. We may have to do this in several steps and then ligate the smaller fragments. It is our plan to complete these tasks by April and analyze the first transgenic lines by the end of the year (2013).



Field trials with transgenic peppermint lines. We are currently assessing the field performance of two transgenic peppermint lines: (1) MFS7A, in which menthofuran synthase (MFS) is expressed in antisense orientation to lower MFS expression levels; and (2) MFS7AA, where the MFS7A line was taken through an additional round of tissue culture. Because of delays with the issuance of a permit for these field trials by USDA, the plants were not brought into the ground until June 2012. Plant material was harvested in September and subjected to hydrodistillation. The oil yield from cultivar MFS7A was slightly lower (3 percent down) and that of MFS7AA dramatically higher (50 percent up) than the yields obtained with Black Mitcham controls. The oil composition was very similar in the transgenic plants and Black Mitcham controls, with the exception that menthofuran and pulegone levels were very low in both transgenic lines.

Efficacy of Coragen® and Avaunt® Insecticides Applied Pre-Harvest for Control of Mint Root Borer in Northeast Oregon

Bryon Quebbeman, Quebbeman's Crop Monitoring, La Grande, Oregon

Coragen® and Avaunt® are registered for control of foliar feeding cutworms, but have been used little because they cost more than the other commonly used products. However, Coragen and Avaunt are systemic, have a longer residual than other products and they have ovicidal properties. This combination could provide pre-harvest control of the Mint Root Borer (MRB) in the egg and/or first instar stage instead of controlling it post-harvest.

Objective

Test efficacy of 5 fl oz/A Coragen and 3.5 oz/A Avaunt when applied at different pre-harvest dates for control of mint root borers.

Two sites were located in production peppermint fields near La Grande, Oregon. At each site a randomized block design with five replications was set up on four separate treatment dates.

Sampling for the MRB larvae took place about ten days after swathing for Experiment One and 28 days for Experiment Two. Evaluation of the MRB larvae control was done by digging eight, 0.75 square feet soil/rhizome samples in each plot. The soil was shaken off the mint rhizomes and sifted through a 0.125" screen. The rhizomes were placed in Berlese funnels until dry and the total number of MRB larvae (combined data from soil sifting and Berlese funnel extraction) was recorded.

Results and Discussion

Experiment One clearly shows that the first three application dates and the double application of Coragen significantly lowered the MRB levels compared to the untreated check (Table 1). This is the first documented control of MRB pre-harvest with any insecticide labeled for mint. The heavy rainfall that occurred 2.5 hours after the Coragen was applied in Experiment One had no apparent negative effect on the control of the MRB. The last application date of Coragen and all of the Avaunt treatments did not lower the MRB larvae levels compared to the untreated check.

It is curious that the MRB levels in the untreated check level are lower than all of the Avaunt treatments and last Coragen treatment. This may be due to sampling error caused by some of the untreated plots being sampled about four days earlier than the rest of the plot area.

Table 1 Experiments One and Two. Pre-harvest applications of 5 fl oz/A Coragen and 3.5 oz/A Avaunt insecticides for control of Mint Root Borer eggs/first instar larvae. (La Grande, Summer 2012)

Treatment Number	Treatment	Accumulated Degree-days Imbler, Oregon	Application Date(s)	Average Live Mint Root Borer Larvae Per Sq Ft			
				Exp.1		Exp.2	
1	UTC			4.5	b	1.07	bc
2	Coragen	737	7- 9	0.67	a	0.03	a
3	Coragen	919	7-18	0.13	a	0.17	ab
4	Coragen	1,023	7-24	1.03	a	0.3	ab
5	Coragen	1,219	8-4	7.67	cde	1.04	bc
6	Coragen	919 +1,219	7-18 + 8-4	0.1	a	0.1	a
7	Avaunt	737	7- 9	9.37	e	0.5	ab
8	Avaunt	919	7-18	6.5	bcde	0.6	ab
9	Avaunt	1,023	7-24	8.17	de	1.53	c
10	Avaunt	1,219	8-4	5.8	bcd	0.63	abc
11	Avaunt	919 + 1,219	7-18 + 8-4	5.13	bc	0.2	ab
	LSD			2.96		0.9	

Experiment One CV=52%, Experiment Two CV=126%

Sample means were compared with Fisher's Protected LSD (p=0.05).

Means with the same letter are not significantly different (Petersen 1985).

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This earlier sampling may have affected the extraction of the MRB larvae from the rhizomes in a negative way.

In Experiment Two the MRB larvae levels were low and unevenly distributed as indicated by the Coefficient of Variation being high (126 percent). Yet two of the Coragen treatments provided significantly lower MRB levels than the untreated check. Experiment Two follows the same trend as Experiment One with all the treatments except the last application date, providing the most MRB control. In addition, the last application date provided the least MRB control in both experiments.

It is speculated that the overhead irrigation may have washed off some of the Coragen onto the lower leaves and/or the soil. This washing off of the Coragen may have increased the effectiveness of the Coragen by coating the entire plant in Coragen and/or providing longer residual control by the mint taking the Coragen up through its roots and translocating it into the entire plant.

The Avaunt treatments provided little to no control of the MRB larvae in either experiment.

Conclusions

Applying Coragen once at 5 oz/A around 750 to 1,000 accumulated DD, pre-harvest, provided significant control of the MRB. In addition, applying it twice at approximately 900 and 1,200 DD also provided significant MRB control. The single application of Coragen at 1,200 DD appears too late to provide any significant control. This research shows that Coragen can control MRB in the egg and/or first instar stage before harvest. Avaunt appears mostly ineffective in controlling MRB eggs and/or first instar larvae at any date.

This Coragen experiment will be repeated in 2013 to verify if pre-harvest control with Coragen can be so effective and consistent over the same accumulated degree-days.

Weed Research in Mint

Rick Boydston, Agronomist, USDA-ARS, Prosser, WA
Ray Baker, Research Technologist III, WSU-IAREC, Prosser, WA

This research develops new knowledge on weed control methods in peppermint and spearmint, including information on the selectivity and efficacy of new herbicides and how to integrate these herbicides into weed management programs for mint. The research also characterized weed resistance to commonly used herbicides in mint production.

Summary of Objectives

1) Identify and evaluate new herbicides for use in mint crops including fall herbicide applications targeting control of rattail fescue and catchweed bedstraw.
2) Determine the extent of herbicide resistant weeds in mint and other mint growing areas.

Actions Taken

Promising herbicides identified from previous studies and other new herbicides were identified and tested for selectivity and efficacy on mint in field trials. Three field trials were conducted targeting control of rattail fescue and catchweed bedstraw in mint.

Herbicide dose response studies on pigweed biotypes collected from Washington mint and potato fields and lambsquarters from potato fields were tested for cross resistance to terbacil. Suspected herbicide resistant weed biotypes were solicited from other mint growing areas.

Results

Sequential applications of pyroxasulfone and terbacil controlled rattail fescue the greatest in native spearmint. Ethofumesate injured native spearmint and peppermint. Define injured peppermint and failed to control most weeds in the trial. Pre-emergence applied sulfentrazone, flumioxazin, oxyfluorfen controlled catchweed bedstraw well in native spearmint. Fluroxypyr and carfentrazone controlled catchweed bedstraw well when applied post-emergence.

Pigweed and lambsquarter biotypes collected from potato fields that were resistant to metribuzin were cross resistant to terbacil. Buctril and Basagran at normal use rates controlled all common lambsquarters resistant to terbacil. Buctril controlled all pigweed resistant to terbacil. Basagran controlled 11 of 14 terbacil resistant biotypes from potato fields similar to the susceptible control biotype, but only partially controlled three other resistant pigweed biotypes.

Efficacy of Coragen® Applied by Two Methods Different Amounts of Irrigation Water for Control of Mint Root Borer in Northeast Oregon

Bryon Quebbeman, Quebbeman's Crop Monitoring, La Grande, Oregon

Coragen® insecticide can be applied by chemigation or by ground sprayer, and then incorporated with overhead sprinkle rirrigation, for control of Mint Root Borer (MRB). Some growers find it more convenient and accurate to ground apply the Coragen and water it in rather than to chemigate it.

Coragen insecticide has been proven to be highly effective in controlling MRB larvae when they are in the mint rhizomes. However, in the fall of 2010 and 2012 some mint fields in the La Grande, Oregon area that had Coragen sprayed on them and then incorporated with irrigation had poor to no control of the MRB larvae. It was speculated that too little water was applied on the first irrigation to incorporate the Coragen. This experiment was designed to test this idea.

Objective

Compare the efficacy of Coragen, when applied with a ground sprayer and watered in with different amounts of water, to chemigating Coragen with different amounts of water.

A single experiment was established post-harvest in a production, wheeline-irrigated mint field infested with MRB larvae. The wheeline that irrigated the field had shut-off valves attached to the sprinklers over the plot area so that no water was applied from the wheeline.

The maximum rate of Coragen (5 fl oz/A) was applied to the dry soil on treatments two through five on August 28, 2012. These four treatments were applied using a $C0_2$ powered backpack sprayer with 20 GPA of water. No surfactant or adjuvant was added to any treatment. Plots were 18' x 20' in size and were replicated five times in a randomized block design.

Water from a nearby mainline was used to hand water each plot with watering wands, approximately 24 hours after the 5 oz/A Coragen was applied (Table 1).

The simulated chemigation treatments were applied on August 29, 2012. The simulated chemigation was accomplished by saturating the soil with water, applying the 5 oz/A Coragen with a $C0_2$ backpack sprayer, then immediately continuing watering (Table 1). The total amount of water applied during this simulated chemigation included the water that was applied before and after the Coragen was applied.

Results and Discussion

The MRB populations were lower than expected and the population densities were highly variable, as shown by the Coefficient of Variation being high at 116 percent. The low level of MRB larvae made it more difficult to clearly see the differences between the treatments and natural variation that occurred in the MRB population.

All treatments reduced the MRB levels significantly at the p=0.05 level compared to the untreated check. In addition, none of the treatments were significantly different from each other (Table 1).

Table 1. Coragen applications of 5 fl oz/A using different amounts of water to incorporate, different methods of applications and dates of water applications. (La Grande area, 2012)

Treatment #	Treatment	Date Coragen Applied	Amount of water Applied (inches/acre)	Date Water Applied	Mean Number Live Mint Root Borer per Sq Ft.
1	Untreated check		2.0	8-29-12	2.8 b
2	Coragen applied and watered in later	8-28-12	0.75	8-29-12	0.3 a
3	Coragen applied and watered in later	8-28-12	1.0	8-29-12	1.2 a
4	Coragen applied and watered in later	8-28-12	1.5	8-29-12	0.5 a
5	Coragen applied and watered in later	8-28-12	2.0	8-29-12	0.3 a
6	Coragen chemigated	8-29-12	0.75	8-29-12	1.0 a
7	Coragen chemigated	8-29-12	1.0	8-29-12	1.0 a
				LSD	1.54

Coefficient of Variation=116%
Sample means were compared with Fisher's Protected LSD (p=0.05).
Means with the same letter are not significantly different (Petersen 1985).

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There is no trend indicating that the amount of water applied after applying the Coragen made any difference in the effectiveness of the Coragen. There was also no trend indicating that chemigating is any more effective than broadcast spraying and watering the Coragen in one day later.

Conclusions

All Coragen treatments reduced the MRB larvae levels significantly after harvest, however, the low number of MRB larvae and the variation make the results less conclusive than they appear.

The total amount of water applied (under two inches) after the Coragen was sprayed on does not seem to impact the effectiveness of Coragen in controlling the MRB.

Chemigating does not appear to be any more effective in controlling MRB than spraying Coragen and watering it in a day later.

An additional study is planned for 2013 to again test the effectiveness of applying different amounts of water after the Coragen is applied and if pre-irrigating before the Coragen is applied is helpful.

News from O.E.O.G.L.

Tim Butler, Chairman, Aumsville, Oregon

Plans are beginning for the 2014 Annual Convention. Be sure to mark your calendars. The dates will be January 9 & 10 at the Salishan Lodge and Golf Resort, Gleneden Beach, Oregon.

If you are interested in advertising in the 2014 Meeting Program and Directory, a mailing will go out in August. If you do not receive the mailing or would like additional information on advertising, contact Kari or Sue at the Association office at (503) 364-2944.

This publication is available in alternative formats upon request.

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